

AMC

AMERICAN METALCASTING CONSORTIUM

VALIDATED PROPERTIES FOR INVESTMENT CAST COMPONENTS



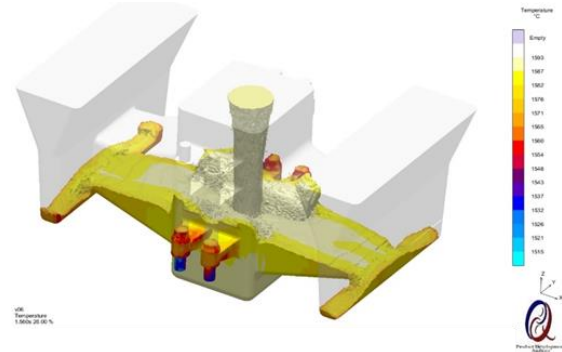
Program Overview and Objectives: A recent AMC research project managed by the American Foundry Society (AFS) developed statistically-based mechanical property data to qualify investment cast steel alloys for inclusion in the Metallic Materials Properties Development and Standardization (MMPDS) handbook. The handbook is used by designers to predict strength and in-service performance of military and aerospace components. Publication of qualified property data in the MMPDS handbook will encourage the use of investment cast steel parts. Fourteen investment foundries participated, producing more than 600 parts. To achieve cast parts that were representative of actual steel components, all samples were produced using designated procedures based on industry-wide best practices. Design, casting, x-ray, heat treatment, and testing parameters were also fully documented.

SUCCESS STORY

Problem: The current MMPDS handbook for military and aerospace components has limited mechanical properties for investment cast steel components. In order to design components as metal castings, engineers need trustworthy and validated data for casting alloys.

Solution: To achieve MMPDS approval, a rigorous program was required to produce a sufficient number of tests to provide statistical validation and confidence. This project produced validated property data for investment cast components in two common steel alloys, 15-5 PH and 17-4 PH, for inclusion in the MMPDS. Each alloy was tested in three different heat treatment tempers. Almost 2000 tests were run to achieve the required level of statistical validation and confidence for MMPDS.

Benefits: The publication in the MMPDS handbook provides statistically-validated data that engineers can trust to design investment cast steel components for military and aerospace applications, as opposed to ad-hoc casting factors, resulting in optimized design and performance of the cast components.



Temperature profile during filling of the test component with molten metal. Filling and solidification were computer simulated prior to actual pouring to assure best properties and absence of internal porosity defects.

“The 15-5PH castings are of particular interest for aerospace structures. Though we have many years of flight history using 15-5PH in both cast and wrought structures, lack of design allowables has limited new applications. The only A/B allowables published publicly for 15-5PH has been for rolled or forged bar. Having investment castings with A/B allowables would be remarkable and noteworthy.” (David Jakstis, Spirit AeroSystems)

“Design engineers now can choose from a total of six grades of 17-4PH and 15-5P alloys for their Investment Cast component and optimize the design using design allowable as opposed to overly conservative designs using random casting knock down factors.” (Jiten Shah, Product Development and Analysis)



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